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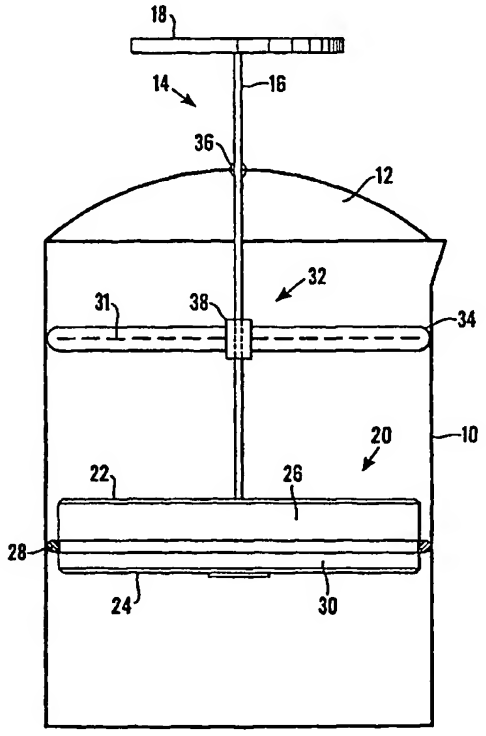
(54) Title: FILTER DEVICE

(57) Abstract

A filter device comprises a fluid–tight container (10), filter means (20) movable through a portion thereof and sealing means (28) between the filter means and the container walls. The method of filtering fluid includes a step in which a filter member traverses the volume of fluid to be filtered.



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FILTER DEVICE

This application relates generally to filter devices. However, aspects of the invention described herein will also have other applications, such as in jug filters and kettles.

Water filter devices are useful, for example, in the removal of unwanted species from water to render it potable and safe for general food preparation. Contaminants are generally removed by some type of filtration process as the volume of water to be treated traverses a filter medium.

Drinking water filters are well known and widely used by both the public and in industry. Many known filters are plumbed directly into a water supply and rely on water pressure to urge the water through the filter medium. However, a number of companies produce jug filters which rely on gravity to filter the water which is poured into the top of a jug assembly equipped with a filter medium.

Known jug filters which cannot easily be fitted into suitcases or other carrying means are not suited for travel purposes or outdoor use owing mainly to their size. Such jug filters take a considerable time to filter a limited quantity of water, for example up to 10 minutes, and require continuous refilling to produce filtered water in sufficient quantity to satisfy most needs, such as those of an average family. Invariably, jug filters are not used to remove bacteria due to the time and/or pressure required to force the water through a filter medium of a suitably fine porosity. Conventional jug filters usually have to be filled by a tap or another jug or kettle. Depending on the filter medium used, the filtered water may be substantially

free of chlorine and therefore susceptible to contamination by airborne contaminants after it has been filtered.

The present invention seeks to provide an improved filter method and filter device.

According to an aspect of the present invention there is provided a method of filtering a fluid in which a filter means traverses the volume of fluid to be filtered.

Preferably, the volume of fluid to be filtered is provided in a fluid-tight container and a filter means movable within the container traverses the volume of fluid such that it traps the unfiltered fluid in a separate portion of the container to the filtered fluid.

According to another aspect of the present invention there is provided a filter device comprising a fluid-tight container, filter means movable though a portion thereof and sealing means between the filter means and the container walls.

Preferably, the filter means comprises a filter member provided on a plunger assembly and includes at least one filter medium. In one embodiment, the filter member comprises first and second filter media and a peripheral sealing element disposed in a position substantially therebetween.

One or more of the filter media, preferably the leading filter media, may be impermeable to bacteria and particulates below a sub-micron dimension, such that these species are entrapped by the filter with other impurities. Preferred filter media are of

known exchange/sorptive types. One or more of the filter media may have antibacterial or bactericidal properties.
According to another aspect of the present invention there is provided a method of protecting fluids from airborne contaminants by substantially covering exposed fluid surface area with a medium having antibacterial activity.

According to another aspect of the present invention there is provided a device for protecting fluids from airborne contaminants comprising a medium having antibacterial properties which is disposed to substantially cover the water surface area.

Preferably, this protection device comprises a substantially two dimensional layer which may be floated upon the surface of the water. Accordingly, preferred protection devices comprise a fine mesh of silver wire supported by a buoyant expanded polymer framework. The shape of the protective layer as a whole generally conforms to that of the container.

Preferred embodiments include a hand operated water press filter which is operable by a plunge action as generally described above. Bacteria and the like can be easily and swiftly filtered from water and the device can be used in various countries on different water qualities and in various situations without the need for water pressure. The device is readily portable and can be easily cleaned and dried making it suitable for use by holiday makers, camping enthusiasts, caravan owners, boat owners, walkers and the like.
Preferred devices also protect the purified water from airborne contaminants since the mesh which is preferably silver provides

the antibacterial activity necessary to compensate for removal of chlorine in the untreated water.

An embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 shows a schematic side view of a preferred filter device;

Figure 2 is a plan view of a preferred water protection device;

Figure 3 is a schematic cross-sectional view of the protection device of Figure 2;

Figure 4 is a graph showing removal of certain elements from a sample of water versus time;

Figure 5 is a graph of removal efficacy against plunge rate; and

Figure 6 is a graph of removal efficacy against bed volume.

Referring to Figure 1 of the drawings in particular, preferred filter devices comprise a fluid tight container 10 having substantially parallel sides (i.e. an approximately uniform or untapered cross-section), a lid 12 which covers the container when in place, and a plunger member 14.

The plunger member 14 comprises a plunger rod 16, a press filter handle 18 at the top of the rod, and a filter member 20

at the bottom of the rod. The plunger rod passes through an opening 36 in lid 12 and a central bush 38 which forms part of protection device 32.

Filter member 20 comprises an upper retaining element 22 and a lower retaining element 24 between which are disposed an upper filter medium 26, an annular sealing element 28 and a lower filter medium 30. Components 22, 24, 26, 28 and 30 collectively make up the filter member 20 also referred to as the "filter cartridge".

Referring also to Figures 2 and 3, there is provided a water protection device 32 on plunger rod 16 between the handle 18 and the filter member 20. The water protection device 32 comprises an antibacterial medium which covers the water surface area. In this example, this medium is a substantially two dimensional fine metallic silver mesh 31 supported on a buoyant expanded polymer frame 34. The fine silver mesh has antibacterial properties.

Depending on the application, the filtration media will be selected to remove unwanted species from water and thereby render it purified. In the case of a water filter for providing water suitable for drinking and general food preparation, contaminants are removed by a process of exchange or sorption on ion exchange and sorptive media contained in the upper 26 and lower 30 portions of the cartridge 20.

The leading filter medium, i.e. the lower filter medium 30 as shown, has antibacterial properties. Typically the cartridge contains a volume of a weak acid cation exchange resin, for

example in the hydrogen ion form having an ion exchange capacity of between about 2 and 4.5 equivalents per litre and a particle size of between about 200 to 1200 micrometers (diameter).

Optionally, the or each resin may be mixed with a volume of a weak basic ion exchange resin having a similar ion exchange capacity and particle size distribution and/or a granular activated carbon with a similar capacity and particle size distribution.

The preferred activated carbon (charcoal) is of vegetable or animal origin and contains elemental silver to inhibit micro-biological growth.

The filter member 20 is replaceable. It can be in various other forms but generally represents a piston-like cartridge of a similar shape to the water-tight container 10. Typically, it is in the form of a flattened cylinder comprising more than a single filter medium.

The dimensions of the filter member 20 are selected to be just less than those of the container 10 such that annular sealing element 28 provides a tight fit where it slidably contacts the internal walls of the container 10. Element 28 ensures no unfiltered fluid escapes outside the filter member 20 during the motion of the plunger assembly and thereby urges all of the water through the filter media during its traverse.

The volume of exchange/sorptive media (known as the "bed volume") is preferably calculated to treat between about 5 and

20 bed volumes of water to ensure removal of between two thirds and one hundred percent of the contaminants present in a single traverse of the water volume. Preferably, the total filtration capacity of the filter member 20 can treat up to one hundred litres of water, depending on the design criteria, and water quality.

The present method and apparatus allows enough pressure to be exerted on the filter medium to ensure a steady downward movement through the water being filtered, removing unwanted contaminants and bacteria.

The filter device is operated by filling the water vessel 10 with water to the required level while the plunger assembly 14 and lid 12 are removed. Then, filter member 20 of the plunger assembly 14 is inserted above the water line and slowly pressed using the handle 18 of the assembly 14. This drives the filter member 20 down through the volume of water to be filtered until the handle 18 prevents further movement by contact with the lid 12 or until the filter member 20 contacts the base of the vessel 10, depending on relative dimensions thereof.

At a first extreme of the preferred plunger 14 motion, the filter member 20 is in a position with substantially all of the unfiltered fluid in front of it.

After the filter member 20 has traversed an initial volume of water under the action of the user's hand, a portion of the fluid has been urged through the filter member 20 and has accumulated behind it. The unfiltered fluid remains separated from the filtered fluid by the sealing action of element 28.

At the furthest extreme of the plunger 14 motion, substantially all of the fluid in the container 10 has been forced through the filter member 20.

Once an initial volume of water has passed through the filter member 20, protection device 32 floats on top of the purified water to protect it from airborne contaminants, including bacteria and particulates. As the filter member 20 continues through the volume of water to the maximum extent of its motion the protection device 32 slides relative to the plunger rod 16 under the buoyant force provided by the floating framework 34.

The treated water can then be decanted from the jug as required. Alternatively, the jug may be stored in a refrigerator or other storage means until such time as it may be required.

Preferred embodiments provide a swift and efficient method of producing large quantities of pure, potable, bacteria free water. The preferred method can be employed with water containers of various sizes according to the required use and water can be introduced to the vessel 10 from large containers or other suitable sources. The apparatus is not constrained by receiving water from taps or jug kettles or other like sources and can receive water by any reasonable means, such as large containers or other suitable sources. Untreated water remains trapped beneath the lower filter medium 30 of filter member 20 which has bactericidal properties while the water above has been filtered in the same action by the upper filter media 26.

As an example, a glass or plastic jug having a substantially uniform cylindrical shape and capable of containing one litre of water to be treated would be used in conjunction with a mounted filtration cartridge 20 (corresponding to filter member 20) of substantially the same internal diameter and containing between about 80 and 140 ml of exchange resin. The mounted filtration cartridge 20 is pushed at a uniform rate through the volume of water using the plunger assembly over a period of about 10 seconds. By comparison to known methods, this period of about 10 seconds required to filter 1 litre of water is far less than the conventional period which would range between 120-220 seconds, for example in the case of a gravity feed jug filter.

Impurities, including bacteria, are swiftly and easily removed from water. The device can be used in various locations, including different countries where water quality varies, and even in situations where there is little or no water pressure available. The apparatus is portable and can be easily cleaned and dried. It is therefore useful in the home and useful for holiday makers, camping enthusiasts, caravan owners, boat owners, walkers and the like. In domestic applications such as tea, coffee or ice making, the filter can produce a sufficient quantity of water to fill an electric kettle or coffee maker (approximately 1 litre).

The design of the water container in combination with the plunger assembly including the filter cartridge enables a compact design which typically approaches half the dimensions of a conventional jug filter having a comparable capacity. Preferably, components of the filter member 20, including the

upper filter medium 26 and the lower filter medium 24 at least, or the entire cartridge including retainers 22 and 24, can be easily recharged, replaced or recycled.

The construction of the filter member 20 shown is not intended to be limiting. For example, it will vary where a different arrangement of filter media 26,30 or a different number of filter media are used.

In one modified version, there is only one filter media. In other modified versions, there will be two or more filter media.

The sealing means and retaining means will depend on the design of the filter member 20. For example, the sealing means, in this example element 28, may be a substantially planar elastomeric disc with openings therein to allow the passage of water or may be an annular member.

Various retaining means may be employed, such as types which are connectable to the plunger rod by a screw thread, bayonet fittings or other removable engaging means.

In another modified version the entire plunger assembly 14 and/or the protection device are replaceable.

Specific examples of filter device are given below.

Tested Filter Medium

An embodiment of filter medium which has been officially

tested comprises a porous (sinter or slotted) cartridge containing a charge of Ion Exchange resin mixed intimately with Granular Activated Carbon. The cartridge is pushed downward through the water to be treated removing Hardness (calcium & magnesium salts) and heavy metals (iron, copper, cadmium, zinc, lead, etc.) using a weak cation selective ion exchange resin, and molecular species such as free chlorine, organic agents and micro-organisms. These are mixed in the volume ratio of 2:1 and applied to the water in the ratio of 1 bed-volume of media (e.g. 150 ml) to 10 bed-volumes of water (1.5 litres) in a single stroke depending on the size of the unit.

The preferred components of the medium are:

1) Resindion Relite™ CND/F, manufactured by Resindion S.R.L. of Milan, Italy, part of the Mitsubishi Chemical Corporation of Japan. The resin is a macro-porous weak acid cation exchange resin of macro-porous polyacrylate/divinylbenzene copolymer with a carboxylic acid functional group in the hydrogen-ion form with the following characteristics:

• Particle size	0.3-0.6 mm diameter spherical beads
• Effective size	0.35 mm
• Total exchange capacity	4.4 equivalents/litre minimum
• Volume change, reversible	$[H^+ \rightarrow Na^+]$ 50%, $[H^- \rightarrow Ca^{2+}]$ 10%
• Shipping weight	0.8 kg/l
• pH operating range	5-14
• Water retention	46-52%

The resin is dry mixed in the ratio (by volume) of 2:1 with;

2) Eurocarb Products Limited Granulated Activated Carbon grade YAO (30 X 60)* with the following characteristics;

- Coconut shell based activated carbon impregnated with 0.05% metallic silver bacteride
- Particle size 0.25 - 0.60 mm
- Surface area 1250 m^2/gram typical
- Shipping weight 0.58 kg/l
- Iodine number 1150 minimum (1200 typical)
- Moisture content 10-15%
- Hardness number 97 minimum

* Note: This product inhibits the growth of bacteria in the filter to prolong the life of the filter and is designed to remove objectionable tastes, odours and colours from municipally treated tap water (USEPA Registration No. 62275-1).

This composition was found to reduce the Total Hardness (combined calcium and magnesium salts) of the water by up to 80% in a single press, besides removing free chlorine, improving taste and colour.

Nitrate removal is achieved by adding Resindion Relite™ A329 weakly basic anion exchange resin to the above in the ratio of 2 CND/F:1 A329:1 YAO; this removed up to 60% of nitrate ion present in a domestic tap water.

2 CND/F:1 A329:1 YAO, this removed up to 60% of nitrate ion present in a domestic tap water.

Test Results

This example of filter medium was submitted to a laboratory for testing the removal of unwanted dissolved chemicals and particles.

The initial tests were done on Buxton Water and Lymington (supplied) and a hard water type typical of the Exeter Laboratory region (Dotton Final Water). The results are in Table 2 below and Figure 6.

Further tests were done on rate of water though the filter, spiking the water(s) with toxic metals to check percentage removal and finally different resins to check on cation and anion removal.

Initial Test

A sample of Buxton Water was analysed before and after passing through the filter as background information. Results showed about 58% removal (as total hardness).

The hard water showed about 43% removal (as total hardness).

Removal of Added Contaminants

The sample was then 'spiked' with various toxic metals to approximately the PCV requirements of the U.K. Drinking Water Inspectorate and again passed through the filter.

Further aliquots were passed through to see if the resin started to deteriorate. There was no apparent deterioration of the resin. See Table 3 below.

The analysis of the spiked sample after passing though the filter was inconclusive, as the metals had been added using standard stock solutions which contained high levels of nitric acid. It is possible, therefore, that the acid strength was too strong for the cartridge to work efficiently. See Table 3 below.

Speed of Plunger Through the Sample

For this test, Dotton Final Water was used.

Analysis was done on the sample for calcium, magnesium and total hardness. See Table 1 and Figures 4 and 5.

As can be seen, the slower the speed of plunger through the water, the better the removal. For future work a speed of 15-20 sec was used.

Use of Different Cartridges for Anion/Cation Removal

Samples of Buxton Spa and Lymington Water were supplied. These were initially spiked with small amounts of metal salts, namely magnesium sulphate, copper chloride and ferrous sulphate, along with small pieces of aluminium and lead wire. These samples were then left overnight for the salts to dissolve.

Aliquots of the spiked samples were taken for analysis and separate aliquots passed through the various cartridges.

The results are in Table 4. However they are considered inappropriate, as the high acidity, low pH, negated the ion exchange capability of the ion exchange resin, being weak cationic.

Table 1

Velocity of plunge mechanism against the efficacy of removal

Contact Time	Calcium mg/l	Magnesium mg/l	Total hardness mg/l	% Removal
0 (sec)	58.6	12.3	79.0	0
10 (sec)	45.2	10.9	63.0	20.3
20 (sec)	29.8	8.4	44.0	44.3
30 (sec)	22.2	7.1	34.0	57
40 (sec)	20.8	7.0	32.0	59.5

Table 3

Capacity of a single ion exchange cartridge over successive plunges, Relite CND/F GAC YAO 2:1

	Volume l	Bed Volumes	Total Hardness	% Removal
After 1 plunge	0.75	5	82.7	61.5
After 20 plunges	15	100	115.8	46.2
After 50 plunges	37.5	250	149.0	30.8
After 75 plunges	56.25	375	165.4	23.1
After 100 plunges	75	500	173.7	19.2
After 150 plunges	112.5	750	181.9	15.4
After 175 plunges	131.25	875	193.5	10.0
After 200 plunges	150	1000	215	0

Table 3

Analyses by South West Water Laboratory, Exeter, Devon

	Before Filter	After Filter	%removal	Before Filter	After filter	%removal
Laboratory Sample No.	39511	39510		39742	39743	
Aluminium (µg/ml)	<5	<5		260	204	
Iron (µg/ml)	<10	<10		210	110	
Manganese (µg/ml)	59.0	25.0		83	84	
Copper (µg/ml)	<1	<1		3200	2160	
Zinc (µg/ml)	<5	<5		5250	4110	
Silver (µg/ml)	0.0	0.0		8	9.7	
Cadmium (µg/ml)	<5	<5		10.8	8.2	
Chromium (µg/ml)	<5	<5		55	48	
Nickel (µg/ml)	<5	<5		53	42	
Lead (µg/ml)	<1	<1		514	242	
Calcium (mg/l)	56.5	22.2	60.7	56.8	62	0
Magnesium (mg/l)	20.3	9.5	53.2	209	26.6	87.3
Sodium (mg/l)	26.0	19.7	24.2	25	33	0
Potassium (mg/l)	1.1	0.7	36.4	1.1	1.6	0
Sulphate (mg/l as SO_4^{2-})	13.0	13.0	0	12	12	0
Chloride (mg/l)	37.0	37.0	0	35	38	0
pH @ 20C	8.3	6.9		2.51		
Total Hardness (mg/l)	90.0	38.0	57.8	91	106	0
Conductivity µs/cm	462	259		2000		

Table 4

Comparison Of various manufacturers ion exchange resins

Sample		Strokes	Contact time sec.	Total Hardness ppm	%Removal		Alum.
A	Run 1	ONE	15	120	45		
A	Run 2	ONE	17	120	53		
B	Run 1	ONE	16	140	36		
B	Run 2	ONE	17	100	60		
C	Run 1	ONE	13	160	27		
C	Run 2	ONE	17	50	80		
D	Run 1	ONE	14	120	45		
D	Run 2	ONE	14	70	73		
E	Run 1	ONE	10	140	36		
E	Run 2	ONE	17	100	60		
F	Run 1	ONE	15	120	45		
F	Run 2	ONE	16	70	73		
G	Run 1	ONE	18	155	40		
H	Run 1	ONE	16	70	73		
I	Run 1	ONE	15	170	33		
I	Run 1a	ONE	16	155	40		
I	Run 2	ONE	18	85	67		0
Control	Buxton			220			10
Control	Lymington			255			0

Notes:

Samples A, B, C, D, E & F Runs 1 E & F Run 1	original results
Samples A, B, C, D, E & F Runs 2 E & F Run 1	new results
Samples G, H Runs 1	new results
Samples I Runs 1 & 1a	new results before and after overnight soak
Sample I Run 2	result after improved sealing

Results in mg/litre total hardness

Resin A - Rohm Haas weak cation exchange resin HP333
Resin B - same as A but screened to reduce oversize beads
Resin C - Resindion Relite CND/F
Resin D - same as C but lower size range
Resin E - Purolyte C107E
Resin F - same as E but lower size range
Resin G - Dow MAC-3
Resin H - Sybron CCP
Resin I - Mixed R&H HP333/HP555 (nitrate removal)

All mixed with Eurocarb GAC YAO (30x60) in ratio 2:1 except I, 2:1:1.

CLAIMS

1. A filter device comprising a fluid-tight container, filter means movable though a portion thereof and sealing means between the filter means and the container walls.

2. A device as in claim 1, wherein the filter means comprises a filter member provided on a plunger member.

3. A device as in claim 2, wherein the plunger member is operable by a hand action of the user.

4. A device as in claim 2 or 3, wherein the filter member includes more than one filter medium.

5. A device as in claim 4, wherein the filter member comprises first and second filter media and the sealing means comprises a peripheral sealing element disposed in a position substantially between said first and second filter media.

6. A device as in any preceding claim, wherein at least one filter medium has bactericidal properties.

7. A device as in claim 6, wherein the leading filter medium has bactericidal properties.

8. A device as in any preceding claim, wherein at least one filter member is operable to remove bacteria, particulates and other impurities of sub-micron dimensions.

9. A device as in any preceding claim, wherein at least one filter media is selected from ion exchange and sorptive types.

10. A device as in any preceding claim, comprising means for protecting the filtered fluid from contamination by airborne contaminants.

11. A device as in claim 10, wherein the means comprises a medium having antibacterial properties which is disposed to substantially cover the water surface area.

12. A method of filtering a fluid in which a filter member traverses the volume of fluid to be filtered.

13. A device for protecting fluids from airborne contaminants comprising a medium having antibacterial properties which is disposed to substantially cover the fluid surface area.

14. A method of protecting fluids from airborne contaminants by substantially covering exposed fluid surface area with a medium having antibacterial activity.

15. A filter device substantially as described herein with reference to Fig. 1 of the accompanying drawings.

16. A device for protecting fluids from airborne contaminants substantially as described herein with reference to Figs. 2 and 3 of the accompanying drawings.

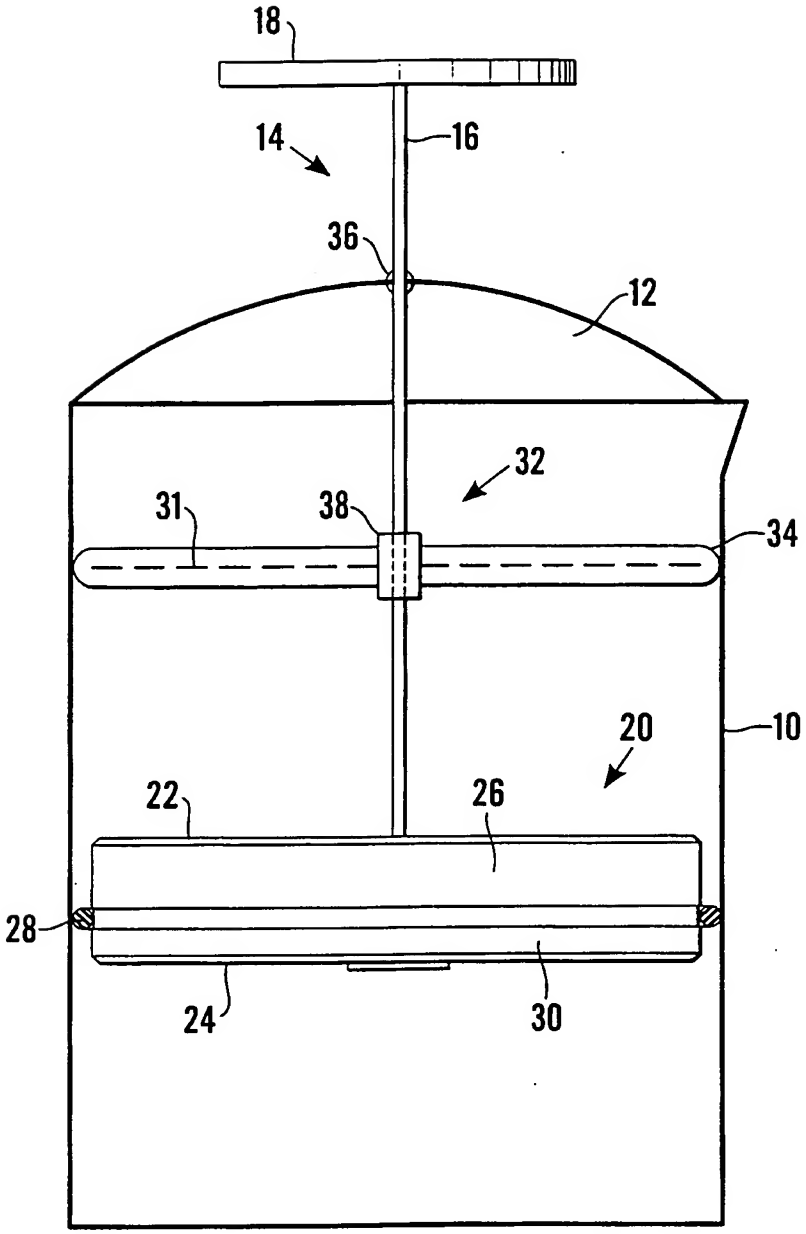

Fig. 1

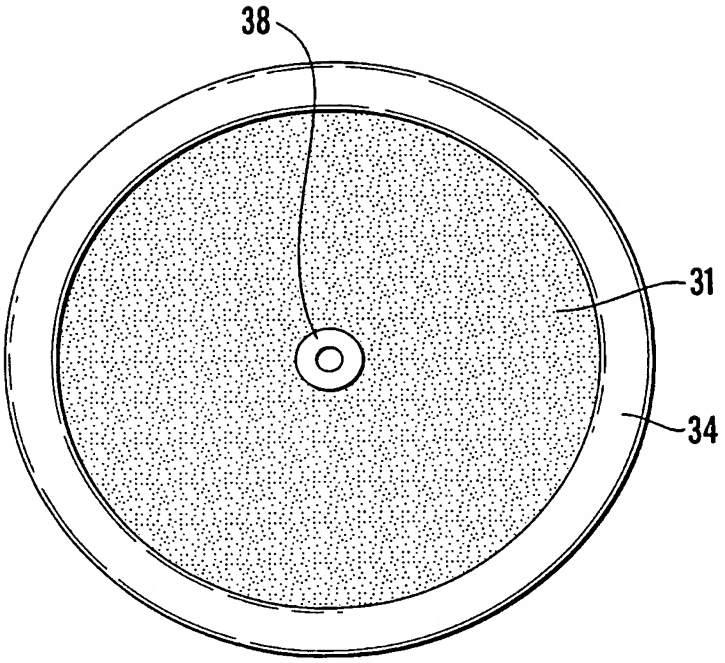

Fig.2

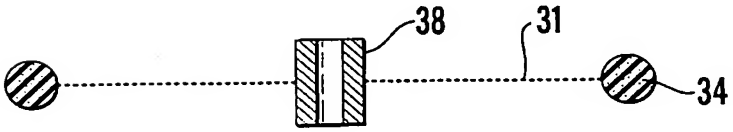

Fig.3

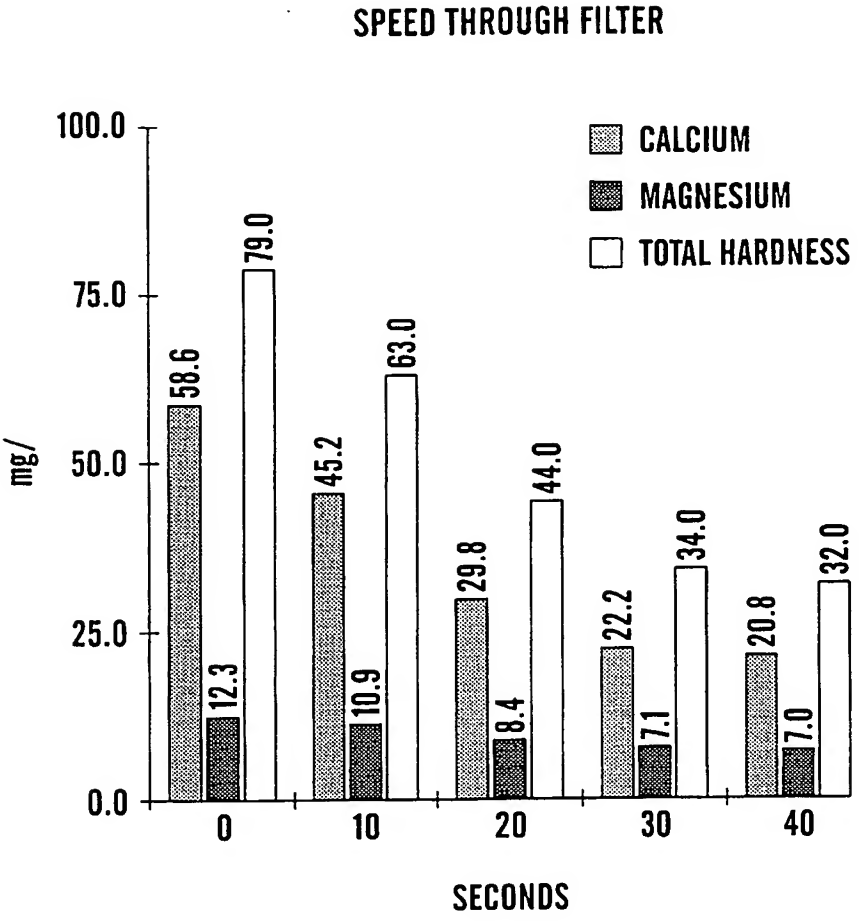
SPEED THROUGH FILTER
CALCIUM
MAGNESIUM
TOTAL HARDNESS
100.0
75.0
50.0
25.0
0.0
mg/
58.6
12.3
79.0
45.2
10.9
63.0
29.8
8.4
44.0
22.2
7.1
34.0
20.8
7.0
32.0
0
10
20
30
40
SECONDS

Fig.4

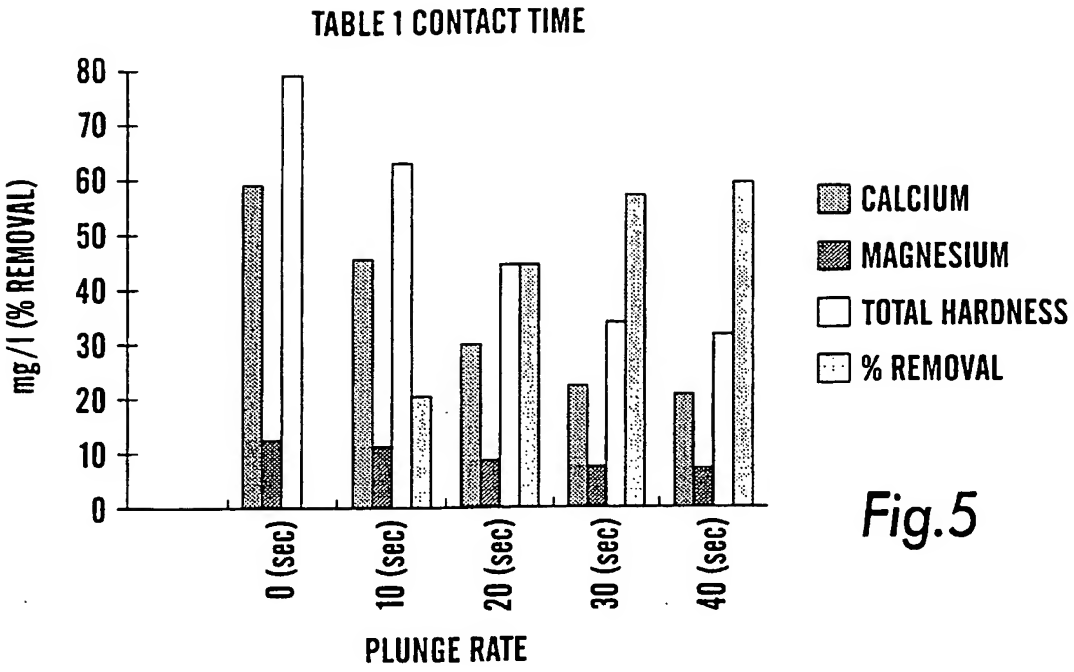
TABLE 1 CONTACT TIME
mg/l (% REMOVAL)
80
70
60
50
40
30
20
10
0
0 (sec)
10 (sec)
20 (sec)
30 (sec)
40 (sec)
PLUNGE RATE
CALCIUM
MAGNESIUM
TOTAL HARDNESS
% REMOVAL

Fig.5

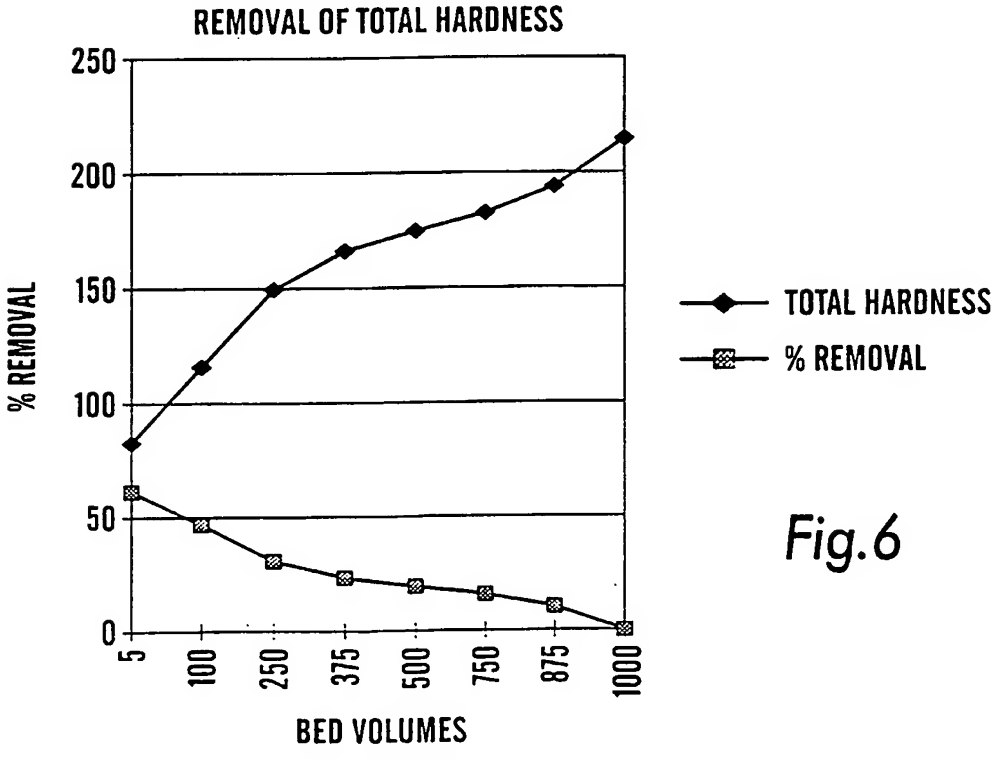
REMOVAL OF TOTAL HARDNESS
% REMOVAL
250
200
150
100
50
0
5
100
250
375
500
750
875
1000
BED VOLUMES
TOTAL HARDNESS
% REMOVAL

Fig.6

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 99/00965

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B01D33/01 C02F1/00 C02F1/50

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B01D C02F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 080 699 A (TECHNION RES & DEV FOUNDATION;SHIMONI MOSHE; CAIS MICHAEL) 10 February 1982 (1982-02-10) page 2, right-hand column, line 104 - line 116 page 3, left-hand column, line 3 -right-hand column, line 107 page 5, left-hand column, line 4 - line 28 page 5, right-hand column, line 112 -page 6, left-hand column, line 14; figures 1-5	1-10,12, 15,16
X	EP 0 297 441 A (BASF CORP) 4 January 1989 (1989-01-04)	1,2,10, 12,15,16
A	page 5, line 30 -page 7, line 8; figures	5
X	US 5 567 309 A (LEAZENBEE LOUIS O ET AL) 22 October 1996 (1996-10-22)	1,4, 6-10,15
A	the whole document	5

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 February 2000	3 MARCH 2000 (03.03.00)

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Van Belleghem, W

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Int ional Application No
PCT/GB 99/00965

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 262 792 A (SMITH & NEPHEW ASS) 6 April 1988 (1988-04-06) page 4, line 53 -page 5, line 17; figures	13,14
A	US 5 795 343 A (YAVITZ EDWARD Q ET AL) 18 August 1998 (1998-08-18) figures	13,14

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB 99/00965

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte ional Application No
PCT/GB 99/00965

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2080699 A	10-02-1982	IL 60645 A	29-02-1984
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		JP 2005443 B	02-02-1990
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		KR 8500341 Y	07-03-1985
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		US 4897193 A	30-01-1990
		US 4832850 A	23-05-1989
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EP 0297441 A	04-01-1989	US 4921618 A	01-05-1990
		CA 1325386 A	21-12-1993
		DE 3874432 A	15-10-1992
		JP 1099623 A	18-04-1989
US 5567309 A	22-10-1996	NONE	
EP 0262792 A	06-04-1988	AU 601218 B	06-09-1990
		AU 7864287 A	31-03-1988
		GB 2195085 A,B	30-03-1988
		JP 63088118 A	19-04-1988
		US 4765478 A	23-08-1988
		ZA 8706698 A	29-06-1988
US 5795343 A	18-08-1998	NONE	

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-12,15

A filter device comprising a fluid-tight container,filter means movable thougt a portion thereof and a method of filtering a flud in wich a filter member traverse the volume of fluid to be filtered.

INDEPENDENT CLAIM 1
DEPENDENT CLAIMS: 2-11
INDEPENDENT CLAIMS 12, 15

Problem to be solved:
How to provide an improved filter method and filter device.
Solution:
The fluid to be filtered is provided in a container and a filter means movable within the container traverses the volume of fluid such that it traps the unfiltered fluid in a separate potion of the containeer to the filtered fluid.

2. Claims: 13,14,16

A device for and a method of protecting fluids from airborne contaminants by covering the exposed fluid surface.

INDEPENDENT CLAIMS: 13,14,16

Problem to be solved:
How to protect a fluid from airborne contaminants
Solution:
A device comprising a medium which is disposed to cover the fluid surface.